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DEVELOPMENT OF ENGINEERING IN HUNGARY SINCE LIBERATION

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I.

The liberation of Hungary, especially after the "turningpoint year," marked the beginning of the great swing to the construction of socialism in all fields of science in Hungary. This trend was the most forceful in the field of engineering, with respect to the proportions, rate and the new directions of development. This was in complete accord with the basic law of socialism as formulated by I. V. Stalin, according to which the goal of a socialist economy is "the maximum satisfaction of the constantly increasing material and cultural needs of the entire society through the uninterrupted growth and perfection of socialist production, based on the most advanced engineering."

Therefore the general theoretical demand of socialism was one of the reasons why the development of engineering had to be given precedence over other areas of science.

Another reason was the retarded state of Hungarian industry prior to liberation, which was due to a dependence first upon Austrian and later German technology.

The development of engineering in Hungary was considerably retarded compared to that of other fields of science, such as mathematics, physics, geology, and medicine, even though the development of even the latter never was given major attention by the old ruling classes and the governments which were subservient to them. However the development of the latter was still possible with relatively little material means, requiring only very capable individuals.

In contrast, engineering can develop only in the presence of an expanding industry, and even so a considerable amount of industrial, and not strictly laboratory, equipment is essential.

There was no lack of exceptional talent in the field of engineering, either, but most of these individuals could not succeed because of a lack of material necessities, such as Anyos Jedlik, who developed the dynamo principle far in advance of Siemens, or else they sought their fortune in foreign countries. Nevertheless there were some, such as Donath Banki, Otto Titusz Blathi, Tivadar Puskas, Kalman Kando, etc, who managed to develop their ingenious inventions at home on the "Hungarian wasteland" and became the founders of branches of industry with world-wide importance. Hungary's outstanding scientists and inventors succeeded in placing Hungary in the lead in the manufacture of incandescent bulbs, and thus to a certain extent placed Hungary in a leading position in the field of telecommunications engineering also. Such outstanding examples of Hungarian engineering ability however were limited to certain specialized fields of industry and technology. The economic policy of the Horthy regime, which was a traitor to the people, hindered the development of this field also, and made engineering dependent upon German industry and technology. Thus certain industrial branches which carried on a good deal of export production, such as in the field of the manufacture of medicines, the finished products of which were

on a par with the international level, nevertheless remained dependent upon Germany for semifinished products and other basic necessities of manufacture. No research work had been conducted in this field. However, the basic industries which comprise the majority of Hungary's industrial production and which have a profound influence on the degree of development of the public economy, such as mining, metallurgy, machine building, construction, and the various light and food industries, lag far behind the international level due to a lack of organized scientific development. In fact in some industries, such as the construction and construction materials industries, even the elementary developments were not realized due to the competition of primitive and unwieldy but very cheap manual labor.

Under such circumstances the commencement of large scale planning of socialistic industrialization following the successful reconstruction of industry under the Three-Year Plan, which in itself was not merely the reproduction of the old status but was brought about through a considerable increase in the technical level, would not have been possible without the urgent creation of an adequate scientific experimental and research basis for this planning. Without this, the planning, construction, and operation of the modern and large new installations would have been impossible, despite all the friendly aid which may have been forthcoming from the Soviet Union.

First of all the exploitable domestic underground reserves had to be prospected at an increased rate to enable Hungarian industry to depend upon domestic raw material supplies as soon as possible. This required an expansion of geological research work and greater development and application of modern geophysical methods. At the same time, new research institutes had to be created in practically all fields of industry. This was necessary for 2 reasons, to adapt the technological methods, which were already generally known or which had been acquired through exchange of documentation with friendly states, to domestic raw materials and domestic natural conditions, and to prepare for the domestic manufacture of machinery and installations necessary for the new engineering methods and for greater production of export items.

The principal measures which have been taken since liberation for furthering the general development of the engineering sciences and for speeding up technical development are the following.

1. Expansion of the extensive system of industrial research institutions.

2. The support of research work being conducted at the university academic chairs by supplying the academic chairs with adequate personnel and equipment.

3. Reorganization of the Hungarian Academy of Science, including the creation of the department of engineering sciences.

4. Organized encouragement of the engineering and scientific intelligentsia to further the qualitative level and the economy of production. This was executed through the enormous increase in the work of the Engineering and Natural Sciences Societies.

5. The purposeful organization of the creative activity of the working masses, through socialist competition, and the innovator and Stakhanovite movements.

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interdependence of these major developmental trends it may be stated that the creation of the system of industrial research institutions and the development of the research work of academic chairs has resulted in the establishment of the material basis of engineering research. At the same time however the above has enabled the training of large numbers of new research personnel in many industrial fields in which there previously were only one or 2 outstanding representatives of the field of science. In connection with the reorganization of the Academy of Science, the creation of the department of engineering sciences constituted the creation of an intellectual directing center the purpose of which was the unification, coordination, and development of the entire complex of extremely varied branches of engineering science in close conformance with the public economic aims and rate of development of the building of socialism. The development of the engineering and natural science societies into a mass organization of the engineering intelligentsia, the extensive intensification of socialist, and the Stakhanovite and innovators' movement constituted the inclusion of the working masses in the technical development of production, which in addition to effecting a direct improvement in the technical level of production also speeds up the introduction of research results into industrial practice.

The commencement of the general and intensive development of the engineering sciences by the party and the government of the People's Democracy of Hungary was based on unified, coherent, and large scale principles. These principles, the aim of which the assurance of a socialist scientific character for the entire public economy, were based on the experience of Soviet science, and this example has proved to be useful, lasting, and the only proper path of development in Hungary. Although a period of 4 or 5 years was insufficient for the complete realization of such a large scale conception, the same process required several decades for its realization in the Soviet Union. It is not superfluous therefore to cite the soundness and the exceptional significance of this great undertaking in the light of the fact that due to the many remaining insufficiencies and faults many individuals cannot see the forest for the trees, and fail to recognize that the engineering sciences have undergone tremendous advancement in Hungary since liberation and especially during the First Five-Year Plan.

The scientific activities of the technical research institutes, academies, and the Academy of Science itself, or those factors of the engineering scientific development of the public economy which are directly connected with research are discussed in the following.

At present there are 45 engineering scientific institutes in operation in Hungary, 40 of which belong to industry, 4 to the communication industry, and one belongs directly to the Academy of Science. With very few exceptions most of these institutes were created after the liberation and many were created during the past 4 or 5 years, at the cost of an investment of many millions. Some of these institutes, such as the institutes of the steel industry, the nonferrous metal industry, the heavy chemical industry, the petroleum industry, synthetics industry, communications industry, and many other institutes are well equipped with completely new modern buildings, laboratories, plentiful equipment, and elaborate auxiliary shops. Many other important research institutes however still are not satisfactorily equipped, such as the [illegible]ning, measurement technological, construction materials, agricultural [illegible]chinery research institutes, and some others. In view of the latter [illegible]s quite remarkable that despite the unfavorable working conditions these [illegible]satisfactorily equipped institutes have been of important assistance to the [illegible]evelopment of their respective branches of industry.

In their entirety these institutes played an important role in the socialist industrialization of Hungary thus far through furthering technological

perfection, the development of new technological procedures in certain areas, the domestic adaptation of new methods acquired from friendly states, the discovery of new possibilities in the exploitation of domestic raw materials, etc. Although an insufficient amount of attention has been devoted to the exact evaluation of the realization of research results, even approximate calculations show that most institutes already have recovered their entire investment and maintenance costs, and some have recovered several times this amount.

Only several of the more important undertakings of the major institutes are described in detail in the articles pertaining to the individual industrial fields.

Several large institutes are investigating the geographic and hydrographic relationships of Hungary and the discovery of Hungary's mineral deposits and power reserves. One of the largest of the latter institutes is the Hungarian State Geographic Institute, with 200 personnel. The main task of this institute is the detailed mapping of the geography of Hungary, the discovery and complete examination of mineral raw materials, and the collection and processing of documents pertaining to the latter. Among the major accomplishments of this institute are the preparation of the 1:300,000 scale geographic maps and the modern verification of the location of the Mecsek Mountain coal beds.

The State Eotvos Lorand Geophysical Institute, which has undergone very rapid development since liberation at present has several hundred personnel. This institute has attained achievements, especially through the use of the seismic measuring instruments and measuring methods which were developed at this institute, which are of great importance to science and to the public economy.

A new higher order triangulation method has been developed at the Institute of Geodesics and Cartography which result in great savings of time and money in triangulation operations.

The Scientific Research Institute of Water Management, which is the central institution of hydrological research, has 200 personnel.

The water construction experimental model laboratory of this institute is nearing completion and will commence operations in the first quarter of 1955. Among the numerous important works of this institute is the great work which was done in connection with the discovery and exploitation of the utilizable water reserves of the country. The completion of the latter enabled adequate and economical solution of the water supply problems of Hungary's agricultural, industrial, and municipal installations.

The Mining Research Institute is working chiefly on the new technological methods which have been introduced in mining operations, and on the investigation of problems of frontal excavation, coal cutting machines, drill-loading, and other special machines, and on mine safety, air cooling, and ventilation. This institute also developed methods for the purification of various important refractory materials, methods for tying down coal dust within the mines, methods for the rational burning of slag-forming types of coal, conducted research on the method of utilization of bentonite, which is one of the very valuable mineral resources of Hungary, etc.

The Mining Blasting Technique Research Institute developed the millisecond blasting method and adapted it for domestic industrial use.

The Steel Industry Research Institute developed a method for the preparation of the Rudabanya ore. This institute has developed several

economical types of steel which contain only domestically produced alloying metals. In the field of pulverized metallurgy the institute has generally equalled the foreign level in the magnetic processing of iron oxide. This institute has developed various tool blade depositing electrodes and depositing methods used in electroplating, and in the field of iron founding it has developed semi-industrial scale methods for the shell formation in iron castings.

Among the significant achievements of the Nonferrous Metals Industry Research Institute were the improvement of the economical operation of the Bayer method of alumina production and the development of economical methods for processing low content bauxite ores.

The Machine Industry Technological Institute developed methods for the mechanical fitting, glueing, grinding, sharpening and polishing of ceramic discs. These discs can be very effectively used in the working of cast iron. This institute also developed a method for the economic working of tempered steels and of hollow castings.

Among the major achievements of the Thermal Engineering Research Institute are the determination of the optimum fire bed shape for the burning of poor quality coal, development of methods for burning pulverized coal, the modification of fire tube boilers for burning pulverized coal, and, in the field of heat transfer, the development of the small ribbed heat transfer unit and the utilization of the latter in air condensation installations.

Among the developments of the Electrical Industry Research Laboratory which were completely accepted and introduced into industry are the high tension current control, a 0.4-mm-diameter concentric telephone cable, a precision current switch, cable insulation oil, high quality bakelite plates, corrosion-free copper-aluminum connections, and high and low-voltage fuses. The developments of this laboratory which are ready to be placed into industrial use include aluminum sheathed cables and the machine powered cooling of turbogenerators.

The Electric Power Research Institute planned and executed a model of the proposed power transmission network, and tests of great importance to the operation of the national cooperative electric power network already have been performed on this model.

The Construction Materials Central Research Institute, which has been in operation for approximately 2 years, determined the optimum dimensions of an underground furnace with optimal specific consumption of energy, developed a type of colored ceramic covering tile which may be produced from domestic raw materials by very cheap methods, developed an appropriate concrete composition and structural components for the construction of agricultural buildings, and developed a method by which the imported ammoniated sodium carbonate used in the manufacture of glass may be supplemented with sulfate-containing domestic raw materials.

The Institue of Architecture developed several light construction materials which are very important from the point of view both of transportation and wall design.

Among the achievements of the Agricultural Machine Experimental Institute are the further development of the domestic unit motor for use in large capacity caterpillar diesel tractors, and the development, perfection, and adaptation to domestic conditions of numerous important agricultural machines.

The Instrument Industry Research Institute developed many electronic, electrical, and mechanical measuring instruments, outstanding among which is

the crystal filter, the development of which enabled the manufacture for the first time in Hungary of carrier frequency installations. This institute also developed a series of heavy current relays, which now play an important role in the power economy of Hungary, and various automatic measuring equipment and elements (smoke gas analyzor based on the principle of heat conductivity, a pneumatic shepherd, a mechanical compensograph, etc). An important achievement of the institute is the development of an impulse-type telemetering instrument which operates without the necessity of a local current source. The latter is an internationally new design.

In addition to the development of important, very specialized instruments, the Optics and Precision Mechanics Central Research Laboratory also has developed a prototype of a new, very efficient Hungarian photographic camera, and a new type of shadow-free medical operating room lamp.

In the course of research on tungsten the Telecommunications Research Institute has succeeded in producing a type of very hard tungsten, and has produced the first domestic prototype transistor.

The Telecommunications Research Institute has conducted basic modern research which will enable the development of special electronic tubes and increasing the life of classical type electronic tubes. The institute also has solved the problems of fluorescent powders for use in television tubes, problems involving television picture tubes, and has embarked on semi-industrial scale experiments.

The Railroads Scientific Research Institute has conducted successful investigation of the requirements for the use of ferroconcrete bases, with special attention to the safe clearance installations and to electric traction.

The Automotive Transportation Scientific Research Institute investigated the carburetors presently in use from a theoretical standpoint and experimentally developed a type of carburetor which is suitable for domestic production and which results in a saving in gas consumption of automotive vehicles.

The work of the Textile Industry Research Institute extends beyond the search for basic materials to the development of methods for the improvement of quality, the physiological examination of products of the textile industry, to the new technological problems of the finishing industry and the development of continuous processes for use in the textile industry (continuous bleaching and dyeing). The institute has achieved outstanding results in the designing and execution of measuring instruments of the textile industry which are important developments even on an international level.

The principal task of the Leather Industry Research Institute is the experimental investigation of the uses of domestic raw materials (pelts and synthetic tanning substances), the development of quality improvement and automatic procedures for the shoe industry, the development of new types of synthetic leather, and the development of new technological procedures for the production of fur items.

The Wood Industry Research Institute is concerned with the investigation of the properties of wood (physical, chemical, and mechanical), wood protection, wood drying, and the development of new types of synthetic wood. This institute has solved the problems of the bonding of railroad ties, supporting beams, and structural elements, which enables these important structural elements to be constructed from small pieces of wood bonded together.

The training of more than 1,000 independent research personnel must be considered one of the especially outstanding achievements of the activity of the industrial research institutes. This intellectual capacity which has been created within these institutes must be considered an important national asset. According to foreign scientists who have visited Hungary this intellectual group contains a good deal of outstanding talent. Special care should be devoted in the future to the conservation and further development of this intellectual reserve.

Aside from the industrial research institutes the Institute of Measurement Technique and Instruments which was founded under the Academy of Science in 1952 deserves separate consideration. Using the facilities of the previously established electron microscope laboratory this institute succeeded in raising the fields of electronmicroscopy and the measurement technique of electrophoretic, diffusion and ultracentrifuge instruments to the international level of development. The institute has organized a valuable instrument exchange system through which the instrument needs of 600 research laboratories and academic chairs are satisfied by the use of a reserve of instruments worth 6 million forints. These instruments include among others ultraviolet spectrophotometers, X-ray spectrographs, high speed photographic cameras, etc. The department of measurement technology of the institute is about to introduce the most modern foreign methods of thermal optical and radiological measurement.

The reinforcement of the research sections of the technical university academic chairs added greatly to the development of the engineering sciences. In most cases this involved the reconstruction of these sections following liberation. Although only a small fraction of the funds allocated for industrial research could be devoted to the development of the research work of academic chairs, which was due also to the fact that the academic chairs were burdened with heavy instructional tasks and to the spatial limitations of the academic installations, the research performed by the academic chairs still accounts for a relatively large proportion of the total. The most outstanding theoretical specialists in the field of the technical sciences are engaged in these research chairs, including more than 2/3 of all specialists who hold academic degrees, academicians, and holders of doctor's and candidate's degrees. Thus the academic chairs are exceptionally well suited to carrying on research which broadens the theoretical bases of the engineering sciences, and which research often is relegated to the background in the work of the industrial institutes. The Academy of Science extends regular material aid in various amounts to approximately 80 technical university academic chairs for research purposes. Under outstanding scientific direction the development of such chairs as the chair of geodesy and geophysics at the Sopron University, and chair of geochemistry at the Eotvos Lorand University has proceeded at such a rate that new academy institutes or laboratories may now be founded on the basis of the latter institutions.

In addition to the solution of tasks included within the research program, which in general are determined by the department of engineering sciences of the academy, the academic chairs are of great assistance to industry through the solution of problems which they receive directly from the industrial plants, consisting of difficulties encountered in industrial production, and in various analytical, organizational, mathematical problems, or various problems of development. However it must be noted that in essence this relationship at present unfortunately consists of the placing of requests by the plants, and execution of the requests by the academic chairs. The socialist creative cooperation of science and production, which at present is widespread in the Soviet Union and which is characterized by the attitude that the problems to be solved are the joint task of the plant and the academic chair and involve the direct cooperation of theoretical and practical specialists, is only in its early stages in Hungary.

Aside from the research institutes and academic chairs a new, very important field has developed, namely that of the planning offices. The large number of existing planning offices engage the most outstanding experts and both ensure sufficiently large scale technical preparedness and ensure through their work that planning conforms strictly and decisively to the national interests. The latter necessitated the development of a new branch of science. The planning offices were charged with the task of developing planning principles and new methods which will assure that the individual new investments will be economical from the point of view of the public economy. In addition to the solution of practical tasks the planning offices have achieved many results of great theoretical importance.

II.

The creation of the department of engineering sciences of the Hungarian Academy of Science constituted the establishment of a spiritual directing center of the development of engineering research and science. This department was charged with the solution of a difficult task of a type which was entirely new in Hungary. The engineering sciences previously had very few such centers, which had developed spontaneously, and which usually centered about a very few outstanding scientists or inventors. Scientific engineering research had to be systematically developed for the entire field of technology at a pace equal to, or in advance of the tasks of the building of socialism solely on this very inadequate and weak basis. An especially great difficulty of this task was the fact that the methods of the Soviet Academy of Sciences and of the Soviet scientists could be adapted for domestic use only in principle, and new organizational systems had to be found for their complete utilization. The 3-stage system of engineering research which is in general use in the Soviet Union and which assures the complete dialectic interconnection between theory and practice in the field of production and science could not be realized in Hungary. These 3 stages are the plant laboratory which is suitable for the solution of local developmental tasks, the industrial branch research institute which solves problems affecting an entire branch of industry, and the great Academy of Science research institute, which is concerned with long range development problems requiring research of a profound theoretical nature. Because of Hungary's economic limitations compared to the Soviet Union this type of 3-stage research program is impossible. Basically only the middle stage could be realized in Hungary, the development of industrial research institutes, and even this, as became apparent later, had a damaging effect on the plant laboratories due to the transferral of their scientific personnel to the newly formed industrial institutes. Thus the department of engineering sciences had to undertake the direction of national research without its own research basis or scientific apparatus because all the new research institutes had been formed under the various ministries and the department could not directly control the work of these institutions. At the time of its formation the department of engineering sciences consisted of 20 members and a total of 60 industrial branches with more or less independent technology of definite fields of engineering, geological, and communications sciences.

In the light of 5 years of experience, even though the field of research is supported only by several recently created engineering institutes belonging to the Academy of Science, it may be stated that a work program and organizational form has been developed which effectively ensures the control by the academy of engineering research being conducted throughout the country, and enables the Academy of Science to play an increasingly important and initiating role in the proper scientific solution of the basic problems of the development of the public economy. This work method, which has been developed gradually, is the system of extremely specialized permanent committees.

Proceeding on the basically sound principle that the tasks of the Academy of Science include only the larger problems of national importance and that the focusing of attention on narrower technical fields would distract attention from the broader goals, only a small number of permanent committees were formed at first, with jurisdiction over broad areas of science. There were no more than 10 or 12 such committees, including the machinery, metallurgical, mining, and geological committees, etc. However, when the first problem of national importance was encountered, it became apparent that the concrete solution of complex tasks was possible only if every component of the complex is developed with adequate scientific thoroughness and competence. Thus the development of the First Five-Year Plan of scientific research required the extensive specialization of the main committees. This very important work was the first step in the method of the planning of the development of science in Hungary, and the experience gained along this line indicated the necessity of continued and increased specialization. In this manner a total of 900 of the best scientific engineering specialists of the country were gradually absorbed into the work of the academy. Through these committees the scientific direction activity of the Academy of Science is very effective in the field of industrial research and planning and even effects the work of the leading economic organs. Several hundred recommendations and reports have been developed by the committees during the past years. The latter ranged from broad problems affecting the public economy of the entire country to detailed problems of the development of individual branches of industry and comprised important scientific guidance in respect to research or to the development of industry. In many instances the committees at least called the attention of the agencies involved to the necessity of taking certain scientific aspects into consideration. Among the most general recommendations of the committees along this line and which are of national importance is the First Five-Year Scientific Research Plan, which is mentioned above. This plan was of necessity adapted to the Increased Five-Year Plan, and therefore could be realized only in small part. Despite the latter, the five-year scientific research plan should be considered a very important piece of work which extended to practically all the theoretical problems of the developmental possibilities of the public economy.

After the Third Party Congress, and at the initiative of the department, including mobilization of its entire committee system, the department developed the first outline of long range development of the public economy, including the national scientific research plan. This gigantic work, which was acclaimed by the leading governmental agencies, is of considerable aid in the concrete development of the Second Five-Year Plan of the public economy. Finally the most recent work of the department which was of great national importance was the supervision of the plan of the rationalization of industrial research. Many important projects currently under way are based on the recommendations developed in connection with the latter and are aimed at easing and improving the work of the research institutes.

In addition to these general problems of national importance the committees of the department conducted complex work on practically every major problem of the public economy, including detailed aspects of the latter. The committees conducted the correlated development of problems such as the major requisites of energy production and energy management and the detailed problems of national importance connected with the latter, including among others the problems of the Danube hydroelectric plants, the national cooperative power system, the possibilities of rationalization of existing thermoelectric power plants, industrial problems related to the construction of new thermoelectric power plants such as boiler manufacture, the problems of the production of special steel necessary for the manufacture of boilers, the electrification of the railroads, etc.

One of the most important undertakings of the main committee on hydrology was the development of the national water economy plan. This plan contains the basic initial data for the further development of the public economy with respect to all the major problems of Hungary's water economy, such as drinking and industrial water supply, protection measures against Karst water, and problems involving mineral water, the purification of sewage, irrigation and irrigation canal construction, etc.

In the field of machinery, the technical committees have had an important part in bringing about the progress which has been achieved in the proper design of important and essential machinery used in the chemical industry, in contributing to the great advances which have been made in the manufacture of more efficient pumps and compressors, in the improvement of the design of turbines, in the commencement of systematic research aimed at the improvement of the design of machine tools, etc.

Through close cooperation with metallurgical plants, research institutes, and academic chairs, the nonferrous metallurgical committees have done important work in furthering the solution of important problems of the nonferrous metals industry, especially the aluminum industry. The above committees performed a comparative evaluation of the various bauxite processing methods, made recommendations for the development of Hungary's very neglected nonferrous and light metals semifinished products production, initiated and directly furthered the production of ferrous alloys utilizing domestic alloying components and the metallurgical processing of vanadium mud, and helped clarify many practical and theoretical problems of the technology of alumina production, including the wet grinding of bauxite, mixing alumina with the use of air, etc.

The ferrous metallurgical committees were concerned mainly with the long range problems of pig iron and steel production. In the course of this work the committees made recommendations for the supplementation of very hard imported metallurgical coke with domestic fuels made possible by the construction of a shallow crater metallurgical furnace utilizing an oxygen-enriched air feed, recommended the use of high pressure in the mouth of blast furnaces, etc. The committees recommended the introduction of the oxygen converter method for overcoming the increasing shortage of scrap in the steel industry. The committees also investigated the Krupp clump-formation method and the problem of the removal of sulfur from generator gas. In addition to the above the committees discussed the interrelated aspects of the necessary and possible quantitative and qualitative long range development of Hungarian ferrous metallurgy from pig iron production through to the manufacture of semifinished steel products.

In the field of communications technology the technical committees are attempting to eliminate the recently detectable increasing departure of this important export industry from the international technical level. Along this line the committees did some important work in the improvement of the design of several products, and developed some exceptionally important and effective activity in the field of the qualitative improvement of basic materials of communications technology. The latter problems could not have been solved by the plants without extensive scientific assistance. The results which have been achieved in this field enable the development and manufacture of better quality, more modern parts with smaller dimensions, and thereby enable the development and production of considerably better designed complete units.

The main committee of measurement and instrument technology has an especially important role in the entire field of scientific research, and also is important with respect to the improvement of the quality of industrial products and the extensive automatization of industry in the future.

This explains the fact that this was the first field in which the direct reinforcement of the work of a main committee by the scientific research reserve of the Academy of Science was recognized as being absolutely necessary, and which resulted in the establishment of the first research institute of the academy of an engineering nature, the Institute of Measurement and Instrument Technology.

This main committee also initiated the creation of the Academy Research Tools Manufacturing Enterprise (Kutesz), for the purpose of alleviating the shortage of instruments in scientific and industrial research. This plant manufactures special instruments of precision mechanical, electrical technological, optical and glass technological nature, only one or very few of which are needed in research work, and which therefore cannot be produced on an industrial scale. Thus it is apparent that the further development of this plant is very important to domestic research.

Prior to the establishment of the light industry research institutes in 1949 research in this field was sporadic, and no significant results were achieved. The research work which was begun at that time enabled the training of scientific personnel in this field, and the creation of the light industry main committee of the academy channeled this research work along definite directions.

Through its work in this field this committee is gradually eliminating the previously dominant empirical methods of research, and has commenced initiation of individual research projects of a theoretical nature.

The transportation science main committee is performing the first pioneering and organization work in Hungary for the exploitation of those scientific principles and achievements pertaining to transportation and shipping which now constitute a great scientific field in the Soviet Union. Despite their exceptionally great importance to the public economy the problems of transportation, shipping and traffic had not been considered to be creative theoretical scientific tasks in Hungary, and the development of scientific cadres in the individual fields of communication was begun only after the formation of the academy committees.

One of the outstanding projects of these committees was the development of methods pertaining to the determination of transportation capacities which already have received practical application, the development of problems of operational planning for the purpose of the development of traffic regulation, the optimal distribution of traffic between the various branches of transportation, and investigation of the technical and organizational requirements of expediting vehicular traffic.

The projects initiated jointly by the transportation science main committee and other technical committees, primarily the machinery and power committees, are very important from the point of view of coal conservation and from the point of view of the entire energy economy of the country, through the electrification of the railroads and conversion to diesel locomotives.

The intensive and broad scientific work being done in important engineering fields by academy committees, such as in the fields of geography, geodesy, geophysics, electrical technology, architecture, etc, cannot be treated in detail in the present volume. This listing is only an illustration of the fact that the reorganized academy now is a creative force in the direction and speeding up of progress in all fields of engineering science and has initiated scientific development of many fields which previously were dominated by raw empiricism and which were geared to entirely outmoded and backward industrial practices.

In most cases the engineering science members of the academy committees are leading members of the corresponding METESZ societies also. This greatly ensures proper distribution of work between the Academy of Science and the engineering societies. This constantly crystallizing distribution of work consists essentially of the primary task of the academy, which is the assurance that the development of scientific research furthers the long range development of the public economy, and the task of the METESZ societies, which is the assurance of industrial exploitation of scientific achievements, and extending direct aid in the most economical realization of plant production tasks. Thus the activity of the department of engineering sciences of the academy and of the METESZ societies, including the work of the industrial research institutes and academic research, constitutes a continuous chain for the final utilization of all new scientific discoveries for the benefit of the entire society through their application in industrial production.

The liberation of Hungary opened a new era of the flowering of Hungarian engineering sciences. The data which have been described in the foregoing, although merely isolated examples and do not give a thorough picture of the full extent of development which has taken place, nevertheless constitute irrefutable proof that such a new era has begun. It is understandable that attention was preferably focused on Hungarian achievements on the occasion of the anniversary celebrations. However the very magnitude of these achievements makes possible the bold exposure of the serious shortcomings which still exist in the field of engineering sciences. The major shortcomings are the following: the exceedingly uneven distribution and inadequacy of research capacity, especially in the light and food industries and in the field of agricultural technology; inadequate scientific planning; the complexity and excessive obligations of administrative direction and control, supply of instruments and materials, and of the financial management of the institutes; the overburdening of scientists with administrative duties and duties involving scientific congresses, etc; and especially the hindrances and difficulties which delay the practical realization of research achievements. All this will require a great deal of effort to achieve the development and flourishing of Hungarian engineering sciences befitting the capabilities of Hungarian scientists and of the young talent which is emerging from the masses. Nevertheless proper evaluation of the path which has been traveled and of the difficulties which have been overcome thus far leaves no doubt that the remaining difficulties also will be removed from the path of progress.

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